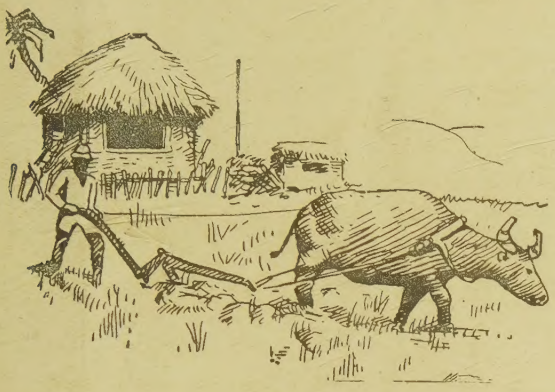
IMP. BUR.
13 JUL. 1926
ENTOM.

The Philippine Agriculturist and Forester



Vol. I December, 1911 No. 10

CONTENTS

	Page
Fertilizer Experiment on Corn	175
Linga	187
Department of Chemistry	188
The Java Sugar Season	189

Published by
THE STUDENT BODY OF THE COLLEGE OF AGRICULTURE
LOS BAÑOS, P. I.

TWO PESOS A YEAR TWENTY FIVE CENTAVOS A COPY

Foreign Subscription: 1.50 Dollars a year.

The Big Book Emporium of the Orient

Makes a specialty of handling *Books* and *Supplies* for schools and students. We carry everything you need at the lowest prices to be found anywhere

We can save you money
and you will get what you want

WRITE FOR CATALOG

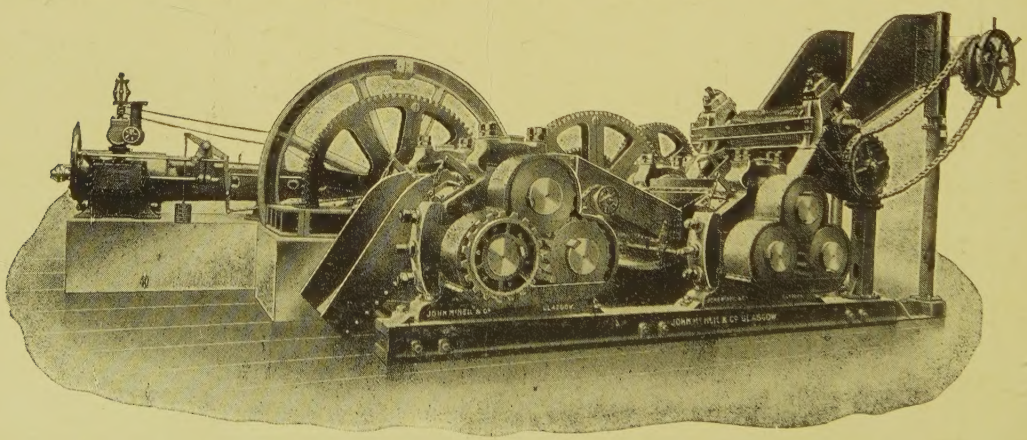
Philippine Education

34-ESCOLTA-34

FRED WILSON & Co.

ENGINEERS

Cane Grinding Plants of Every Description



Complete Factories—Engines and Boilers

41 URBIZTONDO -:- MANILA -:- SAN NICOLAS

Agronomy II boys from an Excursion.

THE PHILIPPINE AGRICULTURIST AND FORESTER

VOL. I. DECEMBER, 1911 No. 10

THE INFLUENCE OF K-P-N ON THE GROWTH AND PRODUCTION OF CORN

TORIBIO N. VIBAR, *B. Agr.*

6,394 experiments with fertilizers on corn soils have been reported in the United States, (Bureau of soils—Bull. No. 64, May, 1910) using 45 substances and 173 combinations of substances. The experiments were carried on with soils of varying fertility. In most cases, they were only for single years, and at most for three to four years, except one series of experiments, which extended through fourteen years.

In this extensive series of experiments, when the minerals were used singly, the five most profitable ingredients were found to rank as follows:

Ingredients:	Marl	Floats.	Wood ashes.	Cotton seed hull ashes.	Kainit.
Am't. applied per acre....	8,600lbs.	291 lbs.	928 lbs.	277 lbs.	31 lbs.
No. of tests	9	11	27	16	84
Gain per acre.....	$4.51	$3.76	$2.38	$1.52	$0.66

Of the organic fertilizers used singly, the only two that were found profitable were tobacco stems, and fish scraps, the amount of each applied per acre was 742 lbs. and 337 lbs. respectively with an average gain of $11.53 in favor of the tobacco stems, and $1.31 of the fish scraps. When two minerals combined were used, the order of effectiveness of the five best combinations was:

Ingredients	Sodium nitrate. Potassium sulphate.	Floats. Wood ashes.	Wood ashes. Sand.	Kainit. Sand.	Muriate of K. Lime.
Ave. gain per A.	$20.0	17.36	14.35	11.46	7.20

From the use of one organic fertilizer with one mineral, the relative efficiency of the five best combinations ranks as follows:

Ground Bone. Sea Weed.	Bone black. Nitrate of soda.	Cotton seed meal. Rock phosphate.	Ground bone. Kainit.	Fish scrap. Kainit.
Ave. gain per A. $11.42	4.76	4.55	4.45	2.36

When three or more minerals were combined, the three most profitable combinations were:

Ingredients:	Sodium nitrate. Rock Phosphate. Muriate of K. Lime.	Sodium nitrate. Muriate of K. Soil.	Ammonium sulphate. Acid Phosphate. Potassium. spte.
Ave. gain per Acre $.....	38.75	7.60	5.30

When one organic fertilizer was used with two or more minerals, the three most profitable combinations were:

Dried blood. Sulphate of K. Sulphate of Ammonia.	Bone black. Sulphate of Ammonia. Acid phosphate. Muriate of K.	Ammonite. Acid phosphate. Muriate of K.
Ave. gain per A. $..... 20.44	15.00	7.88

In Illinois (circ. 149, April, 1911), from extensive experiments undertaken, in which Phosphorous, the only fertilizer used, was applied every four years, it was found in a four-year rotation of corn, or in twenty-four-year rotation with oats and clover, that applying 1,000 pounds of phosphate per acre, the production from the same area was 84 bushels of corn, which with the same system of forming, were increased to 92 bushels per acre when the application of phosphate was increased also to four tons.

Two years experiments with acid phosphate at the Alabama Agricultural Experiment Station (Bull. 111, 1900) by Mr. Duggar resulted in a decrease of one bushel of corn per acre. With the same fertilizer but conducting the experiment at two other places, the results showed practically no increase nor decrease in one; but a decrease of 0.5 bushel in the other. Then, he concluded that "Heavy applications of acid phosphate were useless." The same conclusion he made for Kainit, which in 84 tests used singly in some parts of the U. S. showed increases of 4.2 to 44.5 bushels of corn per acre with an average gain of $ 0.66 from the same area.

From the results obtained through a period of twenty years from the use of nitrogen in complete fertilizers on corn soils, G. C. Watson of Penn. Agric. Exp. Station established the following conclusions (Annual Report of the Station for 1901-1902):—

"Where the nitrogen of the complete fertilizer was applied in the form of dried blood, the yield of corn increased as the amount of nitrogen applied was increased."

"Where the nitrogen of the complete fertilizer was applied in the form of nitrate of soda, the yield of corn decreased as the amount of nitrogen increased."

"Where the nitrogen of the complete fertilizer was applied in the form of sulphate of ammonia, the largest yield of corn was produced by the application of intermediate amount of nitrogen."

From 1,924 tests with single fertilizer on corn soils (Bureau of soils—Bull. No. 64,) Dr. Whitney of the U. S. Dept. of Agriculture stated this interesting conclusion, "Increasing the amount of any single fertilizer from one to ten times does not appear to have any significant effect upon the increased yield from the smaller amounts within the limits of the experiments;" he also concluded from the 6,394 tests with fertilizers on corn soils that "The changes for increase yields and the actual increases are greater with two or three materials mixed than with single fertilizers."

Fertilizer experiment on corn soil in Cebu during the Spanish time was reported by D. Vicente W. Pastor (Boletin Oficial Agricola de Filipinas Vol. I, page 175, June 1894). The result follows:

	Hectoliters per hectare.
Soil and sub-soil mixed with manure	10.50
With lime	6.36
With human excreta	6.25
Manure alone (of cattle?)	5.85
Marl	5.00
Guano	3.50
Native Culture	1.04

Experiments with corn in cylinders was also carried in Cebu in 1893 (Boletin Oficial Agricola de Filipinas, Vol. II, page 48, Feb. 1895). The cylinders were 1.13 m. in diameter, 0.52 m. in depth, and 0.501438 m. in volume, with a surface area of 1,0028 sq. m. The result obtained is shown in the following table:—

	Kind of soil and Fertilizers.	Production Hectoliters per hectare. (estimated)
1.	Soil alone	21.20
2.	Soil with 10 kgs. of manure	33.20
3.	Sand with 15 kgs. " "	40.00
4.	Soil " 100 gms. " guano	16.70
5.	Sand " 100 gms. " "	9.20
6.	Soil " 100 gms. " " and 5 gms. H_2SO_4	28.20
7.	" " 100 gms. " superphosphate of Ca. + 300 saltpeter	37.20
8.	" " 100 gms. " " of Ca + 200 gms. K_2CO_3	25.00
9.	" " 100 gms. " " of Ca. + 300 gms. $(NH_4)_2SO_4$.	43.70
10.	" " 200 gms. " saltpeter	34.70
11.	" " 100 gms. " superphosphate of Ca	10.00
12.	" " 200 gms. " K_2CO_3	10.00
13.	" " 300 gms. " $(NH_4)_2SO_4$	34.50

Another report of Mr. Pastor on experiment with fertilizers on corn soils showed the following:—(Boletin Oficial Agricola de Filipinas Vol. III, page 330, Nov. 1896). Soil mixed with:

	Hectoliters per hectare.	Wt. of 1 hectoliter in kilos.
Manure and bone dusts	57.32	71.65
Marl	55.66	71.42
Animal excreta	47.00	71.90
Chemical fertilizer	46.75	71.70
Manure	44.75	71.60
Lime	30.75	69.70
Bat Guano	24.25	70.50
Check plot	38.12	70.70

From a land heavily dressed with stable manure, the Bureau of Agriculture of the Philippines (Philippine Agricultural Review Vol. IV, page 17, Jan 1911.) obtained a yield of 5,998 kilos of ear corn per hectare from three crops grown successively in one year giving an average yield of 1,999 kilos for one crop.

To determine the influence of tankage, basic slag, and kainit on the growth and production of corn in a soil common in the Philippines is the object of the following experiment:

Preparation of the Soil.—A uniformly level piece of land previously planted with corn, and later badly infested with weeds (grasses, and vines belonging to the family *convulvulaceae*) was plowed three times in about two weeks. The plowing was made cross-wise. Then, disking followed to break the clods. To keep the land uniformly level, it was harrowed several times. Difficulties were encountered in making the soil fine by alternate disking and harrowing due to the scanty rainfall some weeks, before and during the preparation, which made the soil comparatively dry and hard. In the end many clods, especially those turned under could not be broken. The soil was never manured before the experiment was undertaken, and is clay loam in general character.

A rectangular plot of 98m. x 50-m. was laid out, and was divided into nine smaller plots which were separated from each other by a meter wide path. Each smaller plot had an area of 500 sq. m. The plots received applications of Commercial fertilizers as follows:

PLOTS	
I	Control
II	17.5 kg. Kainit
III	17.5 kg. " + 8.75 kg. Basic slag
IV	8.75 kg. Basic slag
V	8.75 kg. " " + 10 kg. tankage
VI	10.00 kg. Tankage
VII	10.00 kg. " + 17.5 kg. Kainit
VIII	10.00 kg. " + 17.5 kg. Kainit + 8.75 Basic slag
IX	Control

Kainit was the source of K, Basic slag of P, and Tankage of N.; K, P, and N being the most important elements for plant growth and consequently most readily taken from the soil. The fertilizers were applied broad cast on Sept. 12, 1911. Efforts have been made to make the application very uniform.

The fertilizers contain the following chemical composition of the most important substances:

Kainit	12.6 % K		
Tankage	12.90 % P_2O_5	14.00%.N	
Basic slag	20 % P_2O_5		

In the following two days, the seeds were sown, three in each hill which was 1 meter apart in every direction. This was done in order to know the exact percentage of the germination of the seeds in each plot. Contrary to the practice of most

Filipino farmers to soak the seeds for about twelve hours before sowing, the seeds were sown directly after shelling. The planting was done with hoe to a depth of about 5-6 cm., a depth enough to reach the moist soil that the seeds could germinate.

The variety of corn used was "native yellow" grown in the college farm and common in the vicinity. Due to the small am't. of corn available, no selection was made on the quality of the ears. The seeds were, however, mixed thoroughly before planting.

On Sept. 25 and 26, a record was carefully taken on the percentage germination of the seeds in each plot. It was found to be 81, 79, 78, 81, 69, 69, 72 68, and 74, in plots I, II, III, IV, V, VI, VII, VIII and IX respectively. As seen from the above, the percentage germination is too low. This is principally due to the dryness of the soil, which gave the ants and probably crickets opportunity to eat the softest parts of the seeds.

The hills were replanted on the same dates. In hills, where nothing germinated 3 seeds were replanted, in the ones, in which one seed germinated two seeds were sown, and in hills, in which two germinated only one seed was sown.

The tasseling and silking were carefully watched out, and the record follows:

Plots		I	II	III	IV	V	VI	VII	VIII	IX
Tassel out	First	Nov. 1,	Nov. 1,	Oct. 28,	Oct. 28,	Oct. 28,	Nov. 1,	Nov. 1,	Oct. 28,	Nov. 1,
	All	Nov. 16,	Nov. 16,	Nov. 16,	Nov. 16,	Nov. 16,	Nov. 16,	Nov. 16,	Nov. 16,	Nov. 16,
	Ave. (for all)	Nov. 19, 1911.								
Silk out	First	Nov. 9,	Nov. 10,	Nov. 7,	Nov. 6,	Nov. 6,	Nov. 9,	Nov. 9,	Nov. 7,	Nov. 10,
	All	Nov. 25,	Nov. 25,	Nov. 25,	Nov. 25,	Nov. 25,	Nov. 25,	Nov. 25,	Nov. 25,	Nov. 25,
	Ave. (for all)	Nov. 18, 1911.								

The above observation was made on the normal plants, disregarding those plants which for some reason or other failed to

Close observation was made on the germination of the seeds. The seedlings were found to come up as follows:

Plots	I	II	III	IV	V	VI	VII	VIII	IX
First	Sept. 17,	Sept. 19,	Sept. 17,	Sept. 18,	Sept. 18,	Sept. 18,	Sept. 18,	Sept. 20,	Sept. 20,
All	Sept. 25,	Sept. 25,	Sept. 25,	Sept. 25,	Sept. 25,	Sept. 25,	Sept. 25,	Sept. 25,	Sept. 25,
Ave. (for all)	Sept. 22, 1911.								

assume their normal activity and development. As may have been found from the above, the plants tasseled in 26 days (average) after sowing the seeds. To know exactly the number of days it would take for the silks to come out after the appearance of the tassels, observation on five plants in each plot was made. It was found that in general, the silk appeared in 7-8 days after the tassels came out.

Cultivation—The different plots were not infested with the same kind of weeds, and the infection was not in the same degree in all. Plots Nos. 2, 3, 5, and 6 were largely infested with vines; plots 7, 8 and 9 with grass weeds and plot No. 1 was comparatively free from weeds. While the plants were yet so young and low that they would be covered when cultivated with cultivators run by animals, weeding with hoes around each hill was done in plots 4 to 9 inclusive on Sept. 30th. There was no need to weed around the hills of plots 1-3. Effort was made to keep the infection of weeds checked or in the same degree. As soon as the danger to cover the young plants from cultivators run by animals became insignificant, the plots were cultivated with double tongueless cultivator which could be managed to break the soil between the plants in the row, first on Oct. 4, second on Nov. 11, and third on Oct. 23rd and 24th. Each plot received an equal amount of cultivation, the depth of which was about 6 cm. in all cases.

As indices to the effect of the fertilizers, growth, and yield of the crop in ears were used; growth showing the plants activities and yield the amount of plant food which could be utilized by the crop under influenced of the fertilizers. For growth 90 seedlings (10 from each plot) of uniform size were picked out from the entire field. The plants selected from each plot were almost in the diagonal of the latter, thus covering the distribution of the fertilizer as much as possible. The growth was measured in the increase in height of the plant. Before the tassel was up, the height of the plant was measured from a fixed point on the surface of the soil to the line just below the base of the blade of the highest leaf. When the tassels were out, the measurement was taken up to their tips. The following table shows the record of the growth of the ten plants from each plot:—

PLOT I

All in mm.

Plant Nos..	1	2	3	4	5	6	7	8	9	10	Average height of the 10 plants.	Weeks	Ave. weekly increase	Ave. daily increase
	Total Height	Total Height	Total Height	Total Height	Total Height	Total Height	Total Height	Total Height	Total Height	Total Height				
Sept 30, 1911	45	51	66	50	61	47	38	35	56	70	51.90	1 & 2	51.90	3.71
Oct. 2, "	51	75	77	68	70	55	65	45	62	83	65.90	....	....	....
" 4, "	60	98	100	80	98	67	85	55	83	95	82.10	....	....	....
" 7, "	80	120	123	110	110	80	105	73	120	115	103.60	3rd.	51.70	7.39
" 12, "	100	156	170	152	135	95	120	85	155	140	130.80	....	....	....
" 14, "	130	200	215	180	180	120	185	130	190	170	170.00	4th.	66.4	9.48
" 18, "	150	255	290	210	245	140	220	150	240	225	212.50	....	....	....
" 21, "	180	320	325	245	270	170	256	154	290	265	247.50	5th.	77.5	11.07
" 28, "	250	550	460	320	420	339	342	175	426	380	366.20	6th.	118.7	16.95
Nov. 4, "	395	1180	610	430	639	345	525	345	430	920	591.90	7th.	225.7	32.24
" 11, "	1150	1960	1170	1095	1370	1027	1642	435	1068	1405	1232.20	8th.	640.3	91.47
" 18, "	1340	2006	1780	1782	1750	1360	1670	1095	1815	1410	1600.80	9th.	368.6	52.65
" 25, "	1390	2006	1785	1790	1750	1356	1665	1550	1820	1420	1653.20	10th.	52.4	7.48
Dec. 2, "	1390	2006	1775	1782	1742	1350	1660	1550	1820	1420	1649.50	11th.	3.7	0.53
" 9, "	1390	2006	1775	1782	1742	1350	1660	1550	1820	1420	1649.50	12th.	.0	.0a

PLOT II

Plant Nos....	1	2	3	4	5	6	7	8	9	10	Average height of the 10 plants	Week	Average Weekly increase	Average daily increase in height of the 10 plants.
Sept. 30, 1911..	69	48	46	50	60	40	27	58	45	52	49.5	1 & 2	49.5	3.53
Oct. 2, " ..	90	55	66	65	75	60	35	70	64	72	65.2	....	....	....
" 4, " ..	100	68	79	76	93	71	40	85	72	83	76.7	....	....	....
" 7, " ..	122	110	85	100	109	92	75	95	78	117	98.3	3rd.	48.8	6.97
" 12, " ..	148	146	122	120	135	160	104	120	100	140	139.5	....	....	....
" 14, " ..	170	185	165	150	153	170	130	145	115	145	152.8	4th.	54.5	7.79
" 18, " ..	200	225	225	205	180	220	170	175	160	170	193.0	....	....	....
" 21, " ..	232	280	260	250	220	260	207	210	185	215	231.9	5th.	79.1	11.3
" 28, " ..	321	370	345	375	310	375	350	360	268	248	332.2	6th.	100.3	14.35
Nov. 4, " ..	440	550	495	495	425	650	478	640	610	322	510.5	7th.	178.3	25.47
" 11, " ..	1252	1480	1180	1630	1086	1215	1230	1082	1215	425	1179.5	8th.	669.0	95.57
" 18, " ..	1658	1860	1680	1760	1601	1520	1620	1672	1870	1220	1646.1	9th.	466.6	66.66
" 25, " ..	1646	1862	1680	1755	1607	1514	1620	1667	1865	1810	1702.6	10th.	56.5	8.07
Dec. 2, " ..	1646	1858	1672	1749	1680	1515	1615	1665	1860	1824	1708.4	11th.	5.8	.83
" 9, " ..	1646	1858	1672	1749	1680	1515	1615	1665	1860	1824	1708.4	12th.	0.	0.00

PLOT III

Plant Nos....	1	2	3	4	5	6	7	8	9	10	Average height of the 10 plants.	Weeks.	Average increase per week.	Average increase daily.
Sept. 30, 1911..	64	60	60	65	90	43	89	85	72	60	68.8	1 & 2	68.8	4.91
Oct. 2, " ..	80	75	80	84	111	50	106	110	94	75	86.5	....	....	....
" 4, " ..	105	95	105	110	132	53	125	132	115	98	107.0	....	....	....
" 7, " ..	115	120	140	145	170	60	160	155	145	135	134.5	3th	65.7	9.39
" 12, " ..	160	160	182	178	178	120	200	192	185	165	172.0	....	....	....
" 14, " ..	200	190	214	200	260	150	240	240	210	200	210.4	4th.	75.9	10.67
" 18, " ..	265	250	265	258	370	175	258	305	286	275	270.7	....	....	....
" 21, " ..	300	305	317	305	450	220	320	380	448	335	338.0	5th.	127.6	18.23
" 28, " ..	405	410	443	442	585	290	455	570	540	505	464.5	6th.	126.5	18.07
Nov. 4, " ..	780	820	940	610	1270	715	1180	1345	1480	1200	1034.0	7th.	569.5	81.36
" 11, " ..	1885	1892	1630	1335	1602	1532	1070	1960	1668	1900	1647.4	8th.	613.4	87.63
" 18, " ..	1892	1893	1945	1507	1600	1730	1867	1960	1720	1910	1802.4	9th.	155.0	22.14
" 25, " ..	1899	1892	1945	1505	1600	1730	1860	1954	1732	1910	1802.7	10th.	.3	0.04
Dec. 2, " ..	1890	1892	1945	1505	1600	1730	1860	1946	1732	1910	1801.0	11th.	01.7	0.24
" 9, " ..	1890	1892	1945	1505	1600	1730	1860	1946	1732	1910	1801.0	12th.	.0	.0

PLOT IV

Plant Nos....	1	2	3	4	5	6	7	8	9	10	Average height the 10 plants.	Weeks	Average increase Weeks.	Average increase daily.
Sept. 30, 1911..	46	55	56	84	52	78	72	56	57	10	56.6	1 & 2.	56.6	8.09
Oct. 2, " ..	55	66	63	100	74	102	80	72	65	32	70.9	....	..	....
" 4, " ..	65	96	79	112	98	125	100	95	80	70	93.0	....	....	....
" 7, " ..	100	116	82	130	110	140	120	119	140	82	113.9	3th.	57.3	8.17
" 12, " ..	175	150	115	155	155	155	150	170	175	110	151.0	....	....	....
" 14, " ..	236	170	125	190	195	175	170	205	205	150	182.1	4th.	68.2	9.74
" 18, " ..	330	248	180	224	280	210	220	250	250	192	238.4	....	....	....
" 21, " ..	380	292	230	247	350	255	255	280	325	255	286.9	5th.	104.8	....
" 28, " ..	625	410	300	345	540	372	400	445	445	312	419.4	6th.	132.5	14.97
Nov. 4, " ..	956	980	350	490	1460	510	1020	1050	940	519	827.5	7th.	408.1	58.3
" 11, " ..	1915	1762	490	1265	1970	1167	1770	1745	1420	940	1444.4	8th.	616.9	88.13
" 18, " ..	2060	1770	1290	1620	1970	1782	1810	1760	1490	1850	1740.2	9th.	295.8	42.25
" 25, " ..	2080	1770	1383	1611	1970	1795	1810	1763	1480	2075	1773.7	10th.	33.5	4.78
Dec. 2, " ..	2080	1762	1383	1611	1970	1795	1810	1763	1480	2075	1773.9	11th.	.2	.03
" 9, " ..	2080	1762	1383	1611	1970	1795	1810	1763	1480	2075	1773.9	12th.	.0	.0

PLOT V

Plant Nos.....	1	2	3	4	5	6	7	8	9	10	Average height of the 10 plants up to date.	Weeks.	Average increase weekly.	Average increase daily.
Sept. 30, 1911..	50	40	32	45	66	48	74	56	83	86	58.0	1 & 2	58.0	4.24
Oct. 2, " ..	60	43	48	60	94	63	85	80	94	120	74.7	....	....	....
" 4, " ..	63	50	50	75	102	80	102	90	120	150	88.2	....	....	....
" 7, " ..	80	63	53	105	130	105	165	120	155	190	116.6	3th.	58.6	8.37
" 12, " ..	100	80	75	150	170	190	205	160	200	230	156.0	....	....	....
" 14, " ..	105	100	92	175	190	237	280	200	255	260	189.4	4th.	72.8	10.4
" 18, " ..	150	130	125	215	255	330	260	270	385	350	247.0	....	....	....
" 21, " ..	163	150	163	240	310	380	525	322	467	415	313.5	5th.	124.1	17.73
" 28, " ..	210	190	dtyd	420	440	590	1360	435	650	580	541.7	6th.	228.2	32.6
Nov. 4, " ..	255	225	....	1050	1100	960	2360	548	1390	1280	1018.6	7th.	476.9	68.41
" 11, " ..	290	485	....	1756	1700	1730	2350	1405	2032	1750	1499.8	8th.	481.2	68.74
" 18, " ..	895	1471	....	1780	1700	2160	2350	1815	2052	1960	1787.0	9th.	287.2	41.03
" 25, " ..	1704	1470	....	1785	1672	2158	2350	1805	2056	1952	1883.6	10th.	96.6	13.8
Dec. 2, " ..	1700	1470	....	1785	1672	2158	2350	1805	2056	1952	1883.1	11th.	.5	.07
" 9, " ..	1700	1470	....	1785	1672	2158	2350	1805	2056	1952	1883.1	12th.	.0	.0

PLOT VI

Plant Nos.....	1	2	3	4	5	6	7	8	9	10	Average height of the 10 plants up to date.	Weeks.	Average increase weekly.	Average increase daily.
Sept. 30, 1911..	42	49	60	60	27	65	62	54	75	62	55.6	1 & 2	55.6	3.97
" 2, " ..	55	63	90	75	40	82	75	60	106	95	74.1	....	....	....
" 4, " ..	58	75	115	86	55	105	85	60	120	105	86.4	....	....	....
" 7, " ..	70	110	140	110	85	115	120	90	138	145	112.3	3th.	56.7	8.1
" 12, " ..	75	145	190	138	138	155	170	120	180	180	149.1	....	....	....
" 14, " ..	128	180	206	185	190	195	210	152	205	225	187.6	4th.	75.3	10.75
" 18, " ..	160	235	270	230	260	250	280	220	250	290	244.5	....	....	....
" 21, " ..	190	280	320	275	355	275	345	265	285	362	295.2	5th.	107.6	15.37
" 28, " ..	272	420	396	405	550	380	460	375	345	538	414.1	6th.	118.9	16.78
Nov. 4, " ..	960	960	595	1008	1410	515	1045	875	680	980	902.8	7th.	488.7	69.81
" 11, " ..	1260	1460	1320	1802	1920	1305	1780	1480	1058	1550	1493.5	8th.	590.7	84.38
" 18, " ..	1380	1860	1565	1860	1930	1585	1856	1992	1280	2030	1733.8	9th.	240.3	34.33
" 25, " ..	1380	1860	1560	1865	1930	1575	1850	1986	1375	2062	1744.3	10th.	10.5	1.50
Dec. 2, " ..	1376	1860	1560	1865	1930	1575	1850	1986	1375	2062	1743.9	11th.	.4	.06
" 9, " ..	1376	1860	1560	1865	1930	1575	1850	1986	1375	2062	1743.9	12th.	.0	.0

PLOT VII

Plant Nos.....	1	2	3	4	5	6	7	8	9	10	Average height of the 10 plants.	Weeks.	Average weekly increase.	Average daily increase.
Sept. 30, 1911..	50	50	53	43	46	67	43	44	50	42	48.8	1 & 2	48.8	3.48
" 2, " ..	64	67	64	46	54	75	58	45	60	45	57.8	....	....	....
" 4, " ..	70	85	75	55	65	95	70	50	75	55	69.5	....	....	..
" 7, " ..	110	90	87	63	82	110	100	80	92	65	87.9	3th.	39.1	5.58
" 12, " ..	170	135	120	77	118	130	135	130	120	75	121.0	....	....	....
" 14, " ..	200	165	145	80	145	160	165	160	145	105	147.0	4th.	59.1	8.44
" 18, " ..	260	175	215	103	195	190	220	215	176	142	209.1	....	....	....
" 21, " ..	315	190	340	142	225	220	280	256	192	160	232.0	5th.	85.0	12.74
" 28, " ..	476	240	372	220	285	310	285	320	250	228	298.6	6th.	66.6	9.51
Nov. 4, " ..	1410	324	560	295	740	730	990	455	340	380	662.4	7th.	363.8	52.4
" 11, " ..	1870	440	1260	750	1375	1410	1350	1240	830	920	1144.5	8th.	482.1	68.87
" 18, " ..	1860	1192	1980	1495	1560	1670	1700	1565	1657	985	1566.4	9th.	421.9	60.27
" 25, " ..	1855	1230	2003	1495	1553	1660	1715	1565	1663	1650	1638.9	10th.	72.5	10.35
Dec. 2, " ..	1855	1225	2003	1492	1553	1660	1715	1565	1663	1650	1638.1	11th.	.8	.01
" 9, " ..	1855	1225	2003	1492	1553	1660	1715	1565	1663	1650	1638.1	12th.	.0	.0

PLOT VIII

Plant Nos.....	1	2	3	4	5	6	7	8	9	10	Average height of the 10 plants.	Weeks.	Average weekly increase.	Average daily increase.
Sept. 30, 1911...	69	68	52	71	60	60	50	55	49	71	60.5	1 & 2	60.5	4.32
Oct. 2, " ...	75	83	63	103	70	80	89	65	68	82	77.8	..	....	....
" 4, " ...	100	105	77	110	80	85	100	75	85	95	91.2	....	....	....
" 7, " ...	120	127	105	150	110	140	140	92	105	135	122.4	3th.	61.9	8.84
" 12, " ...	155	164	130	175	140	170	180	120	150	182	156.6	....	....	....
" 14, " ...	170	190	145	185	190	240	205	152	190	220	188.7	4th.	66.3	9.47
" 18, " ...	210	250	185	230	220	335	280	200	240	280	243.0	....	....	....
" 21, " ...	260	285	235	270	256	420	380	220	268	330	292.4	5th.	103.7	14.81
" 28, " ...	392	438	310	400	347	625	579	300	375	515	428.1	6th.	135.7	19.38
Nov. 4, " ...	660	660	465	965	486	1310	1350	456	460	795	760.7	7th.	332.6	47.51
" 11, " ...	1030	1570	1030	1685	1120	1930	1940	1070	dtd.	1660	1448.3	8th.	687.6	98.27
" 18, " ...	1835	2050	1205	1895	1765	1942	1958	1950	....	2111	1856.8	9th.	408.5	58.35
" 25, " ...	1835	2075	1770	1890	1760	1955	1950	1970	....	2120	1925.0	10th.	68.2	9.74
Dec. 2, " ...	1869	2075	1827	1890	1760	1947	1950	1960	....	2120	1933.1	11th.	8.1	1.15
" 9, " ...	1869	2075	1827	1690	1760	1947	1950	1960	....	2120	1933.1	12th.	0.	.0

PLOT IX

Plant Nos.....	1	2	3	4	5	6	7	8	9	10	Average height of the 10 plants.	Weeks.	Average dally growth of the 10 plants.	Average increase in height of the 10 plants.
Sept. 30, 1911...	62	45	50	67	53	46	78	45	49	58	55.3	1 & 2	55.3	3.95
Oct. 2, " ...	70	50	60	85	65	58	85	55	55	68	65.1	....	....	....
" 4, " ...	72	60	70	92	95	60	100	65	70	75	75.9	....	....	....
" 7, " ...	95	86	115	130	145	75	132	90	110	105	108.3	3rd.	53.0	7.57
" 12, " ...	115	95	170	165	200	119	160	120	135	140	141.9	....	....	....
" 14, " ...	135	120	200	250	260	150	175	160	180	175	180.5	4th.	72.2	10.31
" 18, " ...	195	160	270	310	347	210	220	205	240	220	237.7	....	....	....
" 21, " ...	234	190	310	380	400	240	260	235	270	248	276.7	5th.	96.2	13.75
" 28, " ...	300	255	440	490	495	352	345	354	367	335	373.3	6th.	96.6	13.8
Nov. 4, " ...	440	471	1220	1000	1020	535	500	490	550	535	676.1	7th.	302.8	43.25
" 11, " ...	1060	1360	1880	1630	1740	1220	1275	960	1190	1600	1391.5	8th.	715.4	102.2
" 18, " ...	1760	1820	1880	1680	1760	1820	1886	1112	1320	1624	1577.6	9th.	186.1	26.58
" 25, " ...	1765	1825	1895	1675	1765	1820	1875	1312	1320	1617	1655.7	10th.	78.1	11.15
Dec. 2, " ...	1765	1825	1895	1779	1785	1820	1875	1312	1395	1617	1706.8	11th.	51.1	7.3
" 9, " ...	1765	1825	1895	1779	1785	1820	1875	1312	1395	1617	1706.8	12th.	.0	.0

Plot Nos.	1	2	3	4	5	6	7	8	9	Gen. Ave. wt. of 25 plants	Ave. % of the parts of plants
Wt. of the grains in gms.	2,425.	2,250.	2,825.	2,425.	2,950.	2,300.	2,650.	3,050.	2,425.	2588.	33.73
" " " stalks "	1,042.	1,600.	1,720.	1,925.	1,750.	1,450.	1,650.	2,250.	1,247.	1,737.	22.64
" " " leaves "	800.	850.	1,050.	975.	1,100.	950.	1,050.	1,200.	1,000.	992.	12.93
" " ", Cobs "	793.	660.	824.	775.	776.	697.	792.	880.	736.	770.	10.04
" " " shanks & kusks "	580.	650.	875.	850.	910.	720.	769.	1,032.	714.	789.	10.28
" " " Tassel "	82.	85.	90.	83.	113.	90.	90.	99.	64.	88.	1.14
" " " silk "	23.5	25.	25.25	25.5	42.5	29.4	27.	34.5	30.	29.	0.38
" " " Roots "	233.	679.4	721.3	769.3	817.3	574.4	564.	779.4	402.4	610.0	7.95
" " " Undeveloped ears "	14.65	60.	48.15	92.5	100.65	33.4	90.1	165.	28.1	70.	0.91
Total wt. of 25 plants	5,9993.15	6,859.4	8,181.70	6,920.3	8,559.45	6,844.2	7,682.1	9,489.9	6,646.5	7,673.0	100.00
Ave. wt. of one plant	239.62	274.38	327.26	268.81	342.37	273.76	307.28	379.59	265.86		

parts were separated. In the following figures, the roots were considered as the part of the plant in the soil including the underground stem from which they sprang. For convenience the husks were weighed with the shanks and the tassels with their stalks. After separating carefully, the parts of the plants were allowed to dry. When thoroughly air-dried, they showed the following wts:—

Production of Leaves,—The production of leaves was observed on the ten plants. (in each plot) whose growth were measured, The record follows:—

PLOT NO. 1

Plant Nos.	1	2	3	4	5	6	7	8	9	10	Ave. No. of leaves produced by one plant
Sept. 30, '11	6	7	5	5	5	4	5	4	5	6	17.00
Oct. 7, '11	8	11	7	8	7	7	8	7	8	8	
Oct. 21, '11	13	17	11	11	11	11	12	11	13	13	
Nov. 19, '11	18	20	17	16	16	16	16	17	17	17	

PLOT NO. 2

	6	5	5	5	6	6	4	6	5	5	18.4
	8	8	8	8	8	5	7	8	9	7	
	12	14	13	14	13	13	12	13	14	12	
	19	19	19	19	18	18	18	18	19	17	

PLOT NO. 3

	5	6	6	6	7	5	6	5	6	5	17.7
	7	9	9	9	10	7	8	8	9	8	
	12	15	15	14	15	12	13	13	14	15	
	17	18	19	18	18	17	17	17	17	19	

PLOT NO. 4

Plant Nos.	1	2	3	4	5	6	7	8	9	10	Ave. No. of leaves produced by one plant
Sept. 30, 1911	4	6	5	6	5	6	6	6	6	5	17.6
Oct. 7 "	7	9	7	8	8	8	9	8	9	8	
Oct. 21, "	13	13	12	12	14	13	14	13	15	13	
Nov. 19, "	18	18	17	17	16	18	17	17	19	19	

PLOT NO. 5

	4	5	4	4	7	5	5	5	6	7	17.87
	6	7	6	9	9	9	8	8	9	10	
	9	11	10	14	14	14	14	14	15	16	
	16	16	*	18	18	19	18	18	18	19	

PLOT NO. 6

	4	5	5	5	6	6	5	5	6	7	17.7
	7	8	8	7	9	9	9	8	9	9	
	10	14	14	13	16	13	14	13	13	15	
	16	18	17	17	18	17	18	19	19	18	

PLOT NO. 7

Plant Nos.	1	2	3	4	5	6	7	8	9	10	Ave. No. of leaves produced by one plant
Sept. 30, 1911	5	5	5	5	5	6	6	5	5	5	17.4
Oct. 7, "	8	7	8	7	7	8	9	8	8	7	
Oct. 21, "	14	12	12	10	12	13	14	13	12	12	
Nov. 19, "	17	19	19	17	16	16	17	18	18	17	

PLOT NO. 8

	5	6	5	6	5	6	6	5	5	5	18.88
	7	9	8	10	8	10	10	7	9	8	
	13	14	12	15	12	15	17	11	11	14	
	18	20	19	20	18	18	20	18	*	19	

PLOT NO. 9

	6	5	6	5	5	5	5	5	5	5	17.4
	8	8	9	9	9	7	8	8	8	8	
	12	12	15	14	15	12	12	12	13	12	
	18	17	18	19	19	16	14	17	19	17	

The best 25 plants, whose parts have apparently not been damaged, were carefully pulled out from each plot, and their

THE HARVEST—

The ears were harvested Dec. 26, 1911, 107 days after sowing the seeds. Practically all were dry at this time. They were husked in the following two days, and weighed in the third day after harvesting. The ears were divided into three classes,—"Marketable" "Unmarketable", and "useless." The words may be self-explanatory but due to their unsettled meanings, (varying in different localities) definitions become necessary. "Marketable ears" as here used are those which have fully developed with plump bright kernels. "Unmarketable ears" includes comparatively small ears; ears that failed to develope fully and ears that were attacked principally by fungus; insects, crows, etc. They can also be marketed and not as the word "unmarketable" signifies. "Useless ears," as may be found in the following, were not harvested and weighed at all. They were very small ears without useful kernels.

A few days before harvesting, the entire field was carefully looked through and record on the number to marketable (ears), unmarketable, and useless ears was taken. It was found that very few plants bore two or more marketable ears. Some was found to bear two unmarketable ears, and many bore one marketable or one unmarketable with one or two useless ears.

The following table shows principally the wts. of the ears, excluding those of the 25 plants from each plot, the wts. of the husks from the ears. The number of stalks actually in the field is also included in the table.

Wts. of the Ears (excepting those of the best 25 plants from each plot.)
All in gms.

PLOTS.	1	2	3	4	5	6	7	8	
tal No. of marketable Ears	246.	268.	294.	279.	360.	290.	280.	387.	22
" " " unmarketable "	461.	478.	540.	384.	467.	665.	548.	534.	5
" " " useless "	358.	301.	259.	326.	200.	133.	348.	179.	4
" " " Barren stalks.....	42.	49.	24.	62.	45.	81.	51.	51.	
" " " stalks	1,092.	1,083.	1,104.	1,023.	1,068.	1,149.	1,197.	1,140.	1,0
					kilograms.				
Wt. " marketable Ears	25.333	28.795	29.973	30.310	41.81	18.846	26.006	43.444	
" " unmarketable "	20.284	25.744	28.017	18.712	22.544	28.994	37.801	30.620	
" " marketable } " unmarketable }	45.617	54.539	57.990	49.022	64.354	47.840	63.807	73.064	
					grams.				
e. Wt. " marketable Ears	102.98	107.07	101.95	108.67	116.14	99.47	92.88	112.00	1
" " unmarketable "	44.00	53.44	53.44	48.73	48.27	43.60	68.98	57.34	
" " marketable } " unmarketable }	73.49	80.25	77.69	78.70	82.20	71.53	80.93	84.67	
. of the husks of the Ears...	6,500.00	7,000.00	7,000.00	6,700.00	9,800.00	8,600.00	6,600.00	10,600.00	6,3
	O	K	KP	P	PN	N	NK	KPN	
. of the marketable and unmarketable*	976.7kg	1,148.98	1,232.78	1,044.44	1,361.6	1,016.74	1,344.98	1,539.8	1,1
rs per hectare	1,151.18								
	2,127.88								
Ave.....	1,063.94								

* The ears from the 25 plants from each plot included.

694 experiments on unfertilized plots with corn in U. S.[1] (Bureau of Soil—Bull. 64) showed that the average production in bushels per acre was 4.3 to 90.2, which is equal to 10.62 to 222.79 bushels per hectare. In 1910, the average production per acre was 26 bushels, equivalent to 64.22 bushels per hectare. (Farmers Bull. No. 414, Dec. 1910, U. S. Dept. of Agr.) Twice this amount from the same area is said to be a fair crop; three times a good one, and four times are frequently produced.

A good harvest in Cebu during the Spanish time (Philippine Agricultural Review, Vol. I, No. 8) was 15 hectoliters, and the average production was 10 hectoliters per hectare. One hectoliter was said to weigh 6.9.5 kilos on an average in the Philippines, and 76 kilos in Spain giving then, an average production of 695 kilos per hectare in the Philippines. The same number of the Review shows the following results from a comparative experiment made at Ilagan:

	Hectoliters per hectare.	kgs. per hectare.
Yellow native	22.8	1,574.60
White native	30.6	2,126.70
Horse tooth	41.6	2,891.20

From a test on two varieties of corn made by the Philippine Bureau of Agriculture (Phil. Agri. Review, Vol V., No. 1), the following result was found:—

	Kilos per hectare.	Bushels per hectare.
Maiz variety kalapados	1,290.3 —	50.7
Maiz variety saqueril	0,941.6 —	37.0

From the foregoing table it may have been observed that the average production of the two control plots was 1,063.94 kgs. of husked ears to the hectare. A difficulty is now confronted to compare the yield of corn in U. S. to that in the experiment, for in the former the general measure is "by Volume" and in the latter "by weight" was used. Laws in most parts of the U. S., however, recognize 70 pounds of ears or 56 pounds of shelled corn as a bushel of corn when the ears or the shelled corn contains 15% of water. Applying this connection between weight and volume, it will be found roughly that the production, of corn per hectare in the unfertilized plot was 33.44 bushels, which is only about one-third of the fair production in U. S., or two-thirds of the production of probably the same variety of maiz tested at Ilagan. This yield in this locality is considerably too low due to the unfavorable season. Two times the amount or even two-and-one-half can be produced.

The following table shows an estimate of the value of the fertilizers applied to each plot per hectare and the value of husked ears obtained therefrom:—

Plots.	I & IX	II	III	IV	V	VI	VII	VIII
Fertilizers applied	Nothing	Kainit	Kainit & Basic slag	Basic slag	Basic slag & Tankage.	Tankage	Kainit & Tankage.	Kainit, Basic slag & Tankage.
Amounts applied per hectare.	. . . . .	350 kgs.	350 kgs 175 "	175 kgs.	175 kgs. 200 "	200 kgs	350 kgs. 200 "	350 kgs. 175 " 200 "
Value of the fertilizers per hectare.	. . . . .	₱18.54	₱27.00	₱ 9.00	₱23.01	₱14.00	₱32.54	₱41.55
Value of the husked ears per hectare. . . . (₱0.01 = 1 marketable ear and ₱0.01 = 4 unmarketable ears).	₱71.80	₱77.40	₱85.80	₱75.00	₱95.40	₱91.20	₱83.40	₱104.20
Value of the husked ears per hectare. . . . . (₱0.05—1 kg.)	₱53.19	₱57.45	₱61.64	₱52.22	₱68.08	₱50.84	₱67.25	₱76.99
Ave. value of the husked ears per hectare. . .	₱62.49	₱67.42	₱73.72	₱63.61	₱81.74	₱71.02	₱75.32	₱90.54

Corn is sold in the Philippines usually by the ear which in most parts costs 1 centavo each, and by cavan, which weighs 119 lbs. (Phil. Agric. Review, Feb. 1908) One cavan of shelled corn costs from ₱1.00 to ₱6.00 in different parts of the islands, but in La Laguna where this experiment was undertaken, it cost ₱3.75 (Phil. Agric. Review, Oct. 1911) giving 3.15 ctvos. per lb. or 6.93 ctvos. per kilo. The 75% of the grains to the ear by weight may be found herein to be 77. It is from these facts that the above value of the produce was based.

As seen from the above, the first crop of corn after the application of the fertilizers, was not profitable. This is confirmed by the average result from the 6,394 tests with fertilizers on corn soils in the agricultural experiment stations in the U. S. from 1869-1907 inclusive. The result was reported by Dr. Whitney whose conclussion on the matter follows. "In a great majority of cases, and in the average, the increase of product due to the use of fertilizers on corn soils does not appear to be equal to the cost of the fertilizers used to produce the increase. The average cost of the fertilizers used in all experiments was 7.06 per acre, and the average increase in crop was 9.2 bushels of shelled corn worth at 60 cts. per bushel, $5.52 indicating a net average loss of $1.42 per acre." He further stated that "It would appear that much yet remains to be determined as to how fertilizers act before a rational and economical fertilizer practice can be worked out." However, from the experiment, it should be taken into consideration that not even one-half of the fertilizers were removed from the soil due to the consumption by the crop and otherwise. Assuming that one-half of the fertilizers were removed, the following table will show the gain or loss from the application of fertilizers in the different plots:—

	Average gain per hectare
Plot II	—₱4.34
" III	—₱2.27
" IV	—₱3.38
" V	₱7.75
" VI	₱1.53
" VII	—₱3.44
" VIII	₱7.43

For this kind of soil, therefore, the application of tankage, basic slag and tankage combined or basic slag, tankage and kainit combined is recommended.

The cost of production (preparation of the land, planting, cultivating and harvesting) was approximately ₱60.00 per hectare for the first crop. It may be reduced to ₱42.00 or less in the succeeding crops. From the estimates above, plots I and IX (the check plots) will give a net profit of ₱2.49 per hectare, plot VI ₱4.02, plot V ₱10.24, and plot VIII ₱9.92. In the U. S., estimate made by Mr. A. F. Woods (Year Book, U. S. Dept. of Agr. 1908) showed that the average cost of production per hectare was ₱49.42, and the cost of the produce therefrom, ₱51.87 by selling 74.1 bushels of corn, the average production per hectare at 35 cts. a bushel giving a net profit of ₱2.45 per hectare.

SUMMARY

Corn (variety "native yellow") tasseled in 47 days after planting.

The silk appeared 8 days after the tassel came out. The ears matured in 107 days.

The height of the plant increased gradually with the time; a sudden jump took place in the seventh week after planting; the growth was in its maximum in the eighth week, decreasing suddenly in the tenth and stopped in the eleventh.

From the wts. of the ears obtained, the following conclusions may be drawn:—

The application of single fertilizers ranked as follows: Kainit, basic slag, and tankage. (rank obtained by Penn. Exp. Sta. from 20-year experiment (annual report 1901-1903) is K, P, N.)

The application of kainit gave an increase of 85.04 kgs. of husked corn per hectare. (estimated from the yield in 500 sq. m. plot) The application of basic slag or tankage alone tended to decrease the production slightly. (Using the fertilizers singly, in different parts of the U. S. (Bureau of Soils, Bull. 64, May 1910) kainit in 84 tests was found to give an ave. increase yield of 4.9 bushels of corn per acre

with an average gain of $0.66. Basic slag in 23 tests decreased the production by 0.5 bushel per acre with an ave. loss of $5.07. Tankage in 18 tests decreased the production 12 bushels per acre with an ave. loss of $4.44 from the same area.)

The application of two single fertilizers combined ranked in this order: tankage with basic slag, tankage with kainit, and kainit with basic slag. (rank obtained by Penn from same year experiment as above was K. P, P and N, and N and K.)

Tankage with basic slag increased the yield in husked corn 297.66 kgs. per hectare (estimated.)

Tankage with kainit increased the yield in husked corn 281.04 kgs. to the hectare (estimated)

Basic slag with kainit increased the yield in husked corn 168.84 kgs. per hectare (estimated.)

The combination of the three single fertilizers showed the greatest effect, an increase of 475.86 kgs. of husked corn per hectare (estimated).

The experiment was undertaken during an exceptionally dry season, when the rainfall was below the requirement of the crop. The yield, therefore, was too low, and may be considered to be only about 80% of what it should be under favorable conditions.

Prof. E. B. Copeland planned the experiment, and gave valuable criticism in the preparation of this paper. To him, I am under obligation. Should there be any criticism on the execution of the experiment and on the presentation of the data, the writer is individually responsible.

LINGA

BY ALBERTO BAGUISI

Linga is one of the commercial crops grown in the northern towns of Tarlac province. Special attention is given to its culture in the towns of Anao and Moncada, in which it ranks after corn in quantity, but sells in a higher price.

There are two principal varieties: the white linga and the black linga. The former has a white covering. It produces larger seeds, contains more oil and has a better flavour than the black linga. For these reasons, it sells the dearer.

Linga plant grows best in clay loam soil and in clay humus soil. It is planted in the latter part of the rainy season or in the early part of the dry season in paddies, from which rice has been harvested. The land is plowed and harrowed two or three times or until the soil is well pulverized. Then, the seeds are broadcasted. After broadcasting, the land is harrowed again to cover the seeds. While the plants are young and small, weeds are pulled out to help them grow.

In three to four months after planting, the leaves of linga generally turn yellow, which fact is an indication of maturity. It is then ready to be harvested. The plants are cut by means of bolos or cycles and are tied into bundles. The bundles are dried in the sun on bamboo racks.

When the pods are already dry, they burst easily. The bundles are then shaken every morning on mats or in large baskets. The shaking is continued until all the seeds are separated from the pods. The seeds are freed from impurities (husks, etc.) by winnowing or passing them through sieves. Then, the seeds are ready for the market.

The white variety sells at 30 to 40 centavos per *ganta* and the black, 25 to 30 centavos. Linga is used mainly for the manufacture of cakes and oil.

To prevent the attack of insects, linga seeds are preserved in earthen jars tightly closed with wood ashes, cotton, or clothes.

The Philippine Agriculturist and Forester

Organ of the Student Body of the Philippine College of Agriculture, Published Monthly During the School-year

ENTERED AT THE POSTOFFICE AT LOS BAÑOS, LAGUNA, AS SECOND CLASS MAIL MATTER

₱ 2.00 A YEAR **25 CENTAVOS A COPY**

TORIBIO N. VIBAR, *Editor in Chief*

FELIPE CEVALLOS, ANDRES NAVARRO, *Assistant Editors*

BIENVENIDO M. GONZALEZ, *Business Manager*

FLORENCIO OLIVA, *Asst. Business Manager*

Address all communications to the Business Manager LOS BAÑOS, LAGUNA.

Foreign Subscription: 1.50 dollars a year.

DEPARTMENT OF CHEMISTRY

Several advanced students in this department are engaged in research work as follows:

Valente Villegas, on the effect of fertilizers and stimulants and cogon soil extract on rice in water culture; Bienvenido Gonzalez, on the chemical changes in growing nuts of cocos; Manuel Roxas, on the fat-splitting enzyme of sprouting coconut.

Dr. Deming is also working on cogon soils.

A work similar to that undertaken in the Vermont Agricultural Experiment Station in 1897 on the artificial use of active enzymes in the germination of several kinds of seeds will also be done here The following, taken from the twentieth annual report of the Vermont Agricultural Experiment Station, will show what has already been done along this line: "Pepsin, diastase, pepsin and diastase, extractum pancreatis, trypsin, enzymol, and diastasic essence of pancreas taka diastasa and a tomato seed enzym (?) solution freshly prepared from freshly malted tomato seeds, were used in several hundred trials, more particularly with tomato seed, but somewhat with cucumber, radish and watermelon seed. The tomato seeds were from 5 to 12 years old, the others from 5 to 9 years old.

"In some cases the percentage of germination in seeds is greatly increased by soaking for several hours in a solution containing some active enzym or encyms. The vigor of the young plantlets is often enhanced at the same time. Within limits these beneficial effects increase with the strength of the enzym solution, diastase proving particularly serviceable.

"The various enzym treatments used all act upon the seeds by the conversion of a proportionately large quantity of the starch contained. It can hardly be questioned that this conversion is to the advantage of the seeds in germination. Tomato seeds which react especially well toward various enzym preparations, particularly to diastase, contain an unusual amount of fat. What the connection between these two facts may be is not yet clear. F. A. W. 10:106-111 (1896), 11-211-295 (1897).

Notice To Our Subscribers.

We found it convenient for us to change our period of issue from January-December to July-March, making it coincide with the college year.

Our Vol. II, No. I, will therefore appear next July.

INDEX

VOLUME I

JANUARY, 1911 TO DECEMBER, 1911

A

Abaca, Musa textilis 64, 116; effect of shade on the environment of the abaca plant and on the plant itself 161; grading the fiber 65; leaf 69; machines 65; root 68; uses 66

Acacia catechu 130; koa 130

Achras sapota 125

Achuete 131

Acorda, Vitaliano, notes on 168

Adansonia digitata, baobab 125

Afzelia rhomboidea, tindalo 130

Aganaid, Asota philippina 35

Agave fourcroides 117; mexicana 117

Agricultural conferences 56; exhibits, editorial 137

Agriculture in India 99-104; in Japan 142-3; in Mexico 40

Albano, S., notes on 35

Aleurites cordata 131; moluccana, lumbang 131; trisperma 131

Algaroba, uses of 21

Anay, destruction of 77

Animal diseases, rinderpest 62

Anona cherimolia, cherimoya 126; muricata, guanabano 126; reticulata, anona 125 squamata, atis 126

Anosia chrysippus, nymphalid 34

Areca catechu, betel nut palm 130

Arenga saccharifera, caong 130

Arrow root 113

Artocarpus integrifolia, nanka 126

Asota philippina, aganaid 35

Assimilation of nitrogen by rice 123

Atis 126

Attacus atlas, ilang-ilang moth 33

Averrhoa bilimbi, camais 126

Avocado pear, Persea gratissima 129

B

Bagui, F., black pepper in Batangas 136; notes on 35

Baguisi, Alberto, linga 187

Baker, C. F., work of 42

Banana leaf-roller, Erionota thrax 33

Bartlett, Murray, notes on 63

Beans *see* legumes

Beattie, George W., notes on 16, 63

Beets 114

Betel nut palm *see* Areca catechu

Bixa orellana, achuete 131

Boehmeria nivea, China grass, ramie 117

Botanic gardens, editorial 18

Buildings, dedication of 26

Bureau of Agriculture, conferences 61

Buri 130

C

Cainĝins 43

Caladium colocasia, gabi 23

Calamismis; in India 101; crop 110

Camia 116

Camote *see* sweet potatoes

Camunting 22

Cananga odorata, ilang-ilang 131

Caong *see* Arenga

Carbon bisulphide for the killing of weeds 21

Carica papaya, Ceylon long 126; Ceylon round 127; Zamboanga variety 126

Carissa arduina 127

Carludovica palmata 117

Carnival and agriculture, editorial 36

Cassava 111; maniok varieties 22

Castor oil '16

Catopsilia pyranthe 35

Cecropia peltata 127

Ceiba pentandra, kapok 117

Cevallos, Felipe O., control of disease and pests by cultural methods 26; collection of insects in connection with the study of economic entomology 30; effect of shade on the environment of the abaca plant and upon the plant itself 161; notes on 35, 145

Chaerocampa celerio, gabi moth 34

Cherimoya *see* Anona

Chico *see* Achras sapota

Citrus fruits 17; aurantium, calamansi 127; cumquat 127; decumana 127; limonum, lemon 127; Swatow orange 127

Cocaine 130

Coconut 130; care of plantation 58; cultivation of 57; diseases of 57; fertilizers 58; enemies 59; harvesting 59; physiology of 44-50; products 59; selection of seed 57; transplanting of seedlings 57; uang 57

Coffee industry in the island of Luzon 145-52

College of Agriculture 4; notes 12

Control of diseases and pests by cultural methods 86

Copeland, E. B., abaca 64-73; cainĝins 43; coffee industry in island of Luzon 145; dedication of new buildings 26; letter 169-73; notes on 5; physiology of the coconut 44-50; salutation 3

Corn *see* maize
Corn moth borer, Pyrausta vastatrix 32
Corypha sp., buri 130
Cotton 117; red bug 34
Course in forestry, editorial, E. B. C. 156; summer 16
Cruz, Mariano Manas, live-stock farming and soils 54-5; notes on 5
Curran, H. M., notes on 85
Cuzner, H., notes on 5, 12, 24

D

Day, Artemas L., notes on 85
Dedication of our new buildings 26
Deming, Horace G., notes on 16, 85, 188
Department of Rural Engineering 168
Destruction of anay 77
Diospyros discolor, mabolo 127
Diseases and pests; coconut 57, 59; control of by cultural methods 86; corn 32; gabi moth 34; ilang-ilang moth 33; mango weevil in Florida 102; peanut 157; red cotton bug 34; rice 8, 20; rinderpest 62; silk worm 122
Dryopteris cucullata, a common Philippine fern 171
Durham, S. B., notes on 5; scale of points of Philippine pony 138; some practical advice on horse breeding in the Philippines 13-14
Dysdercus cingulatus, red cotton bug 34

E

Editorials, agricultural conferences 56; agricultural exhibits 36; botanic gardens 18-19; Carnival and agriculture 36; course in forestry 156; employment of students 98; Taal and agriculture 24
Effect of some stimulants on rice 89
Elayda, Inocencio, notes on 85, 145
Enemies *see* diseases and pests
Engineering, rural, department of 168
Entomologist, work of 20
Entomology 30, 31-35, 119, 121-23
Erionota thrax, banana leaf-roller 33
Erythroxylon coco 130
Escaler, Jose, notes on 16
Espino, Rafael, notes on 168
Eugenia jambolana, duhat 128; myrtifolia 128
Exposition, Philippine 134-36

F

Fertilizers; influence of K-P-N on the growth and production of corn 175; and the growth of rice 152-54; live-stock farming and soils 54; for garden soils 81
Field cultures, report on 105-19, 125-32
Forage 107
Forestry; forest reserve, Makiling 15; forests of the Philippines 139; in Bataan 132-34; reforestation 53
Foxworthy, F. W., notes on 85
Franco, Felix, lumbering in Bataan 132-4; reforestation 53; rice-growing in Pampanga 7-8
Fungicides *see* insecticides and fungicides

G

Gabi, Caladium colocasia 23, 113
Gabi moth, Chaerocampa celerio 34
Galang, F., notes on 35
Garden, value of a vegetable 9-10; establishment of a vegetable 38
Garuga floribunda, abilo 128
Gilbert, Newton W., notes on 16
Ginger 113
Gonzalez, Bienvenido, conference of the Bureau of Agriculture 61; notes on 188
Grapes 128
Grass, China 117; moras 107
Griffin, L. E., notes on 16
Guanabano *see* anona
Guava, Psidium guajava 129; var. pomiferum 130; var. pyriferum 129

H

Hawaii agricultural experiment station, activities of 17
Heliophila unipuncta, rice pest 20
Hemp *see* abaca, Indian hemp, Mauritius hemp, Sansevieri zeylanica
Hog-raising in the Philippines 37
Holman, R. M., notes on 5
Horse, breeding in the Philippines 13-14; scale of points for a Philippine pony 138

I

Ilang-ilang, Cananga odorata 131
Ilang-ilang moth, Attacus atlas 33
Indian hemp 117
Insecticides and fungicides; bordeaux mixture 75; carbon bisulphide 77; kerosene emulsion 74; resin wash 75; some of the newer 142; spraying tests 74-7; white arsenic 76
Insects, some local 32; in connection with economic entomology 30
Irrigation of garden soils 80

J

Jasminum sampac, sampaguita 132
Java sugar season 189
Juglans australis, walnut 128

K

Kapo 22; puti 22
Kapok, Ceiba pentandra 117

L

Lansium domesticum, lanson 128
Lavadia P., notes on 35
Ledyard C. S., notes on 5, 168
Ledyard E. M., notes on 5, 12, 24, 85, 145, 168
Legumes; beans, imported 109; beans, native 108; bean, velvet 160; cagyos 111; calamismis 101, 110; chick pea 11; cowpea 108; peanut 107; peanut, diseases of 157; sincamas 107; Spanish lentil 111
Leptocorisa acuta, rice pest 8
Lime, use of, on soils 140
Linga 189
Live-stock farming and soils 54
Lumbang 131
Lumbering in Bataan 34

M

Mabolo, Diospyros discolor 127
Maize, fertilizer 175; crop 106
Makiling forest reserve 15
Mammea americana, mamee apple 128
Manas, Mariano, notes on 105, 145; report of field and nursery cultures 105-19, 125-32
Manganese, influence of, on the growth of pineapple 20
Mangifera indica, mango 129
Mango 129; shield-budding 18; weevil 102
Maniok varieties *see* cassava
Matthews, Donald M., notes on 145
Mauritius hemp 117
Mendiola, Nemesio, notes on 16, 168
Mexican agriculture 40
Michelia champaca 131
Mint 116
Montellano, P., notes on 35
Moras 107
Moringa pterygosperma, horse-radish tree 131
Mulberry 128
Muños, A., notes on 35
Musa ensete 113; textilis *see* abaca
Myristica fragrans, nutmeg 130

N

Nanka *see* Artocarpus integrifolia
Nash, R. F., notes on 5, 85
Nematode worms 42
Nursery cultures, report on 105-19, 125-32
Nutmeg *see* Myristica fragrans
Nymphalid, Anosia chrysippus 34

O

Ocfemia, Gerardo, notes on 168
Okra 115
Oliva, Florencio, notes on 168
Onions 114
Orchard, windbreaks for 18
Oryza sativa *see* rice
Oteyza, Mauricio, notes on 88

P

Pandan industry in Majayjay 11-12
Pandanus sabutan 116
Papaya *see* Carica papaya
Passiflora edulis 142; quadrangularis 115, 141; passion fruit culture 141-2
Pathology, plant, our need of plant doctors 51; *see also* diseases and pests, insecticides and fungicides
Peanut *see* legumes
Peas *see* legumes
Pepper, black in Batangas 136
Persea gratissima, avocado pear 129
Pests *see* diseases and pests
Physiology of the coconut 44-50
Pierid, Catopsilia pyranthe 35
Piña *see* pineapple
Pineapple, Ananassa sativa 125; influence of manganese on the growth of 20; Natal canning 125; smooth Cayenne 125; sugar loaf 125
Potatoes 113; preserving of seed-potatoes 99
Psidium *see* guava
Punica granatum, pomegranate 129
Pyrausta vastatrix, corn moth borer 32

Q

Quisumbing, Francisco, notes on 12, 35, 168

R

Ramie *see* Boehmeria nivea
Raymundo, M., notes on 35
Reforestation 53
Report of field and nursery cultures 105-19, 125-32
Rice army-worm, Spodoptera mauritia 20, 34
Rice, assimilation of nitrogen by 123; effect of some stimulants on 89; fertilizers and growth of 152; growing in Pampanga 7-8
Root crops 23
Roselle *see* Rozelle
Roxas, Manuel, coffee industry in the island of Luzon 145; cultivation of coconut 57; effects of some stimulants on rice 89; notes on 85, 145, 188; Pandan industry of Majayjay 12
Rozelle 115
Rubber; diseases of Hevea 84; Castilloa elastica 40, 118; Hevea braziliensis, Para rubber 118; in Ceylon 82-4; Manihot dichotoma 118; Manihot glaziovii 118; Manihot heptaphylla 118; Manihot piauhyensis 118; Marsdenia verrucosa 118

S

Safflower 116
Salt, Mr., notes on 16
Salutation 3
Sandoricum indicum, santol 129
Sanseviera zeylanica, bow-string hemp 117
Sapindus saponaria 129
Silk worm, culture 119; at the College of Agriculture 119; enemies and diseases 122; method of killing cocoons 122; pupating 122
Soil, conservation of moisture in a garden 81; drainage 81; fertilizers 81; fertility of sterilized 101; irrigation of a garden 80; live-stock farming and 54; management of a garden 79; tillage 79; use of lime on 140
Sorghum 105
Spodoptera mauritia, rice army-worm 20, 34
Spondias lutea 129
Spraying tests of some common insecticides on farm crops 74-77
Strychnos ignatii, Saint Ignatius bean 131; nux-vomica 131
Students, employment of 98
Sugar, cane in Porto Rico 103; cane on College Farm 105; notes 159-60; Java season 189; palm 130
Summer courses 16
Sweet potatoes 112
Swietenia mahogani 131
Swine *see* hogs

T

Tamarindus indicus, sampaloc 129
Tempongko, C., speech 29; notes on 85
Themeda triandra 170
Tindalo 130
Tirona, Emiliano Tria, notes on 16
Tirona, Jose, notes on 168

U

Uang, attacking coconut 57
University news 16

V

Velasquez, B., notes on 35
Velez, Blas, notes on 12, 35
Velvet bean 160
Vibar, Toribio N., College of Agriculture 4; establishment of a vegetable garden 38; influence of K-P-N on the growth and production of corn 175
Management of a garden soil 79-81; notes on 35; our need of plant doctors 51; value of a vegetable garden 9-19
Villegas, Valente, notes on 145, 188; silk worm culture 119

W

Weather report, September 1911, 137; October 1911, 155
Weeds, promising 100; carbon bisulphide for killing 21
Whitford, H. N., notes on 5, 85; work of 139
Windbreaks for orchards 18

X

Xanthosoma sagittifolium, yautia 23

Y

Yabyaban 112
Yam 113
Yautia 23

Z

Zamora, Jose, fertilizers and the growth of rice 152-4; Leptocorisa acuta 8-9; notes on 85

ACKNOWLEDGMENT

This index was compiled by Hazel Kenward, associate professor of chemistry in the College of Agriculture.

The staff of the ***Philippine Agriculturist*** hereby expresses its appreciation of this exacting and valuable work.

The EDITORS